PRELIMINARY HYDROLOGY/DRAINAGE STUDY

FOR

CLUB ESTATES

TM 5499RPL2; ER 06-03-003

OWNERS

V/O Pauma Development, L.P.
P. O. Box 686
Pauma Valley, CA 92061

PREPARED BY

Szytel Engineering & Surveying, Inc.
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Gary M. Szytel R.C.E. 24080, President

Date: March, 2008

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DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the Engineer of Work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

However, given the feasible, conceptual nature of that review, this report has been prepared from a more broad conservative overview in keeping with the preliminary stage of this project's development.

SZYTEL ENGINEERING & SURVEYING, INC.

BY: Gary M. Szytel *DATE:* 3/21/2008

President *R.C.E. 24080* *Expires: 12/31/2009*

REGISTERED PROFESSIONAL ENGINEER
GARY M. SZYTEL
No. 24080
Expires 12/31/2009
CIVIL
STATE OF CALIFORNIA

OVERVIEW OF PROJECT AND METHODOLOGY

This preliminary drainage analysis has been prepared for the discretionary review of the subject proposed subdivision and utilizes the procedures outlined in the County of San Diego Hydrology Manual, June 2003. The enclosed Project Preliminary Grading Plan shows all site information and the vicinity.

The actual development area of this site is removed from the San Luis Rey River and is at the terminus of a gently sloping alluvial plain, a portion of which extends off-site to a topographical peak. These areas will be the subject of this study. Conceptual grading will consist of private roads and pads for single family dwellings on lots no smaller than one acre. The remainder of the project site will be left in its existing condition.

This development area has been used for agriculture in the past. The site carries tributary flows and on-site precipitation in natural and improved swales directly to the river. There are no pre-planned adjacent downstream properties or existing drainage facilities to be impacted.

Drainage development will follow existing patterns. Tributary flows and site runoff will be directed to shallow earthen channels terminating in improved conduits which will outfall at the floodplain's edge. No diversion is proposed. Consequently, conceptual post-development flows and velocities are expected to be approximately equal to pre-development conditions where drainage leaves the property in the San Luis Rey River channel.

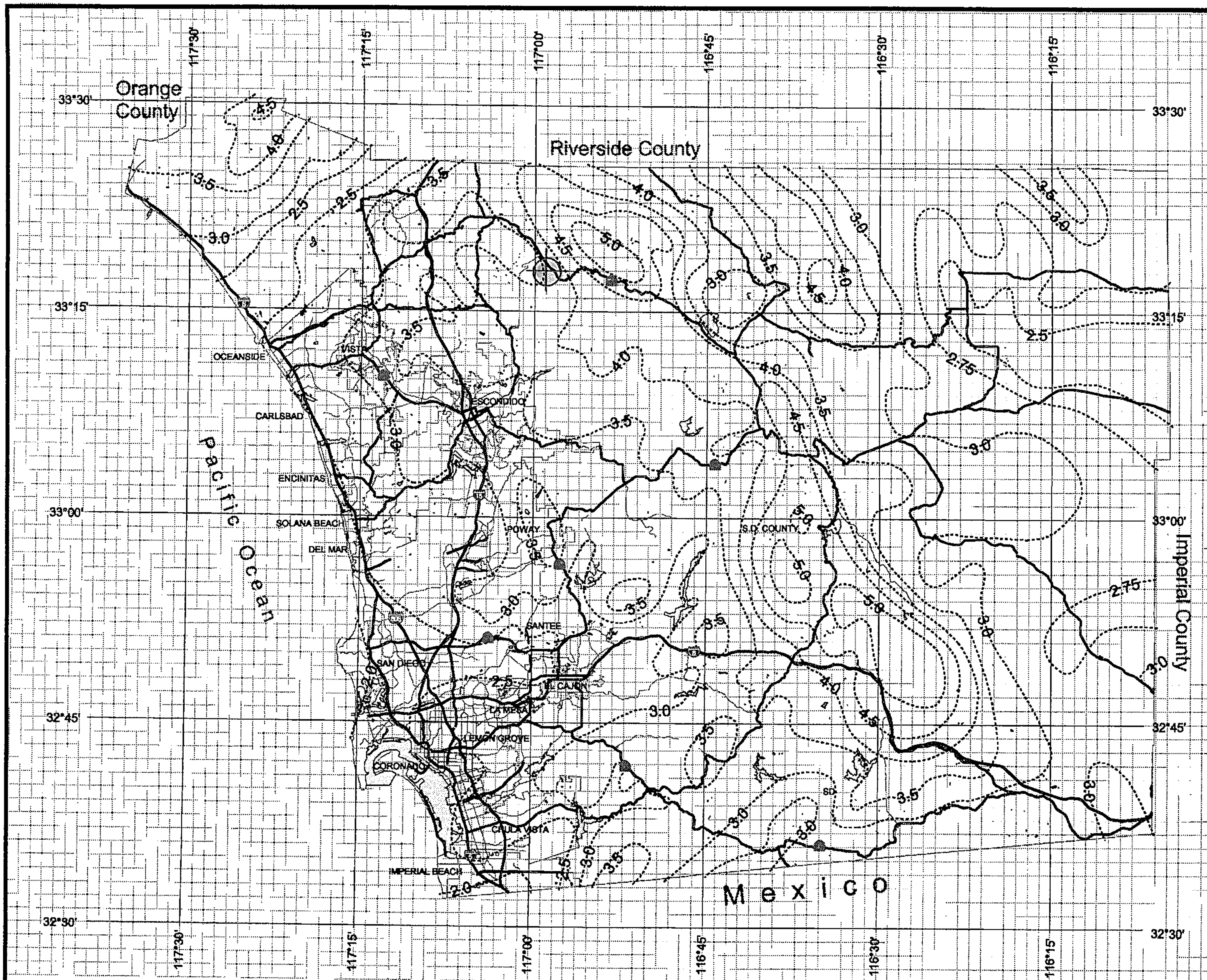
The land use type within the off-site drainage basins is all natural, ranch and agriculture with parcel sizes greater than one acre. Therefore, runoff coefficients have been utilized conservatively for the Off-Site Upstream Hydrology Calculations, per Table 3-1 of the Manual and the Hydrologic Soil Groups Map of the site and surrounding areas. The land use type within the development site is Low Density Residential employing a weighted runoff coefficient. The equations given at the tops of Figure 3-1 and Figure 3-4, were utilized in spreadsheet format for each pre-development drainage basin and for the basins after conceptual construction for the purposes of this preliminary analysis.

The County Flood Plain Map showing lines of inundation of record on the project site has been enclosed. The area within the floodplain may be open space easement.

The overall Drainage Basin Map is a composite of County Ortho and Topographic Maps 414-1773, 418-1773 and 418-1779 which have been reduced to 1" = 400'.

The final design of all ditches and storm drain systems will include consideration of energy dissipation improvements for non-erosive outfall conditions. Please see the Project Preliminary Grading Plan for locations of proposed private facilities.

The proposed shallow and wide open channels have been designed to also function as water quality treatment facilities for flows reaching the San Luis Rey River. Their "soft-bottoms" are intended to allow infiltration and provide natural aesthetics for wildlife.



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

-------- Isopluvial (inches)

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3 0 3 Miles

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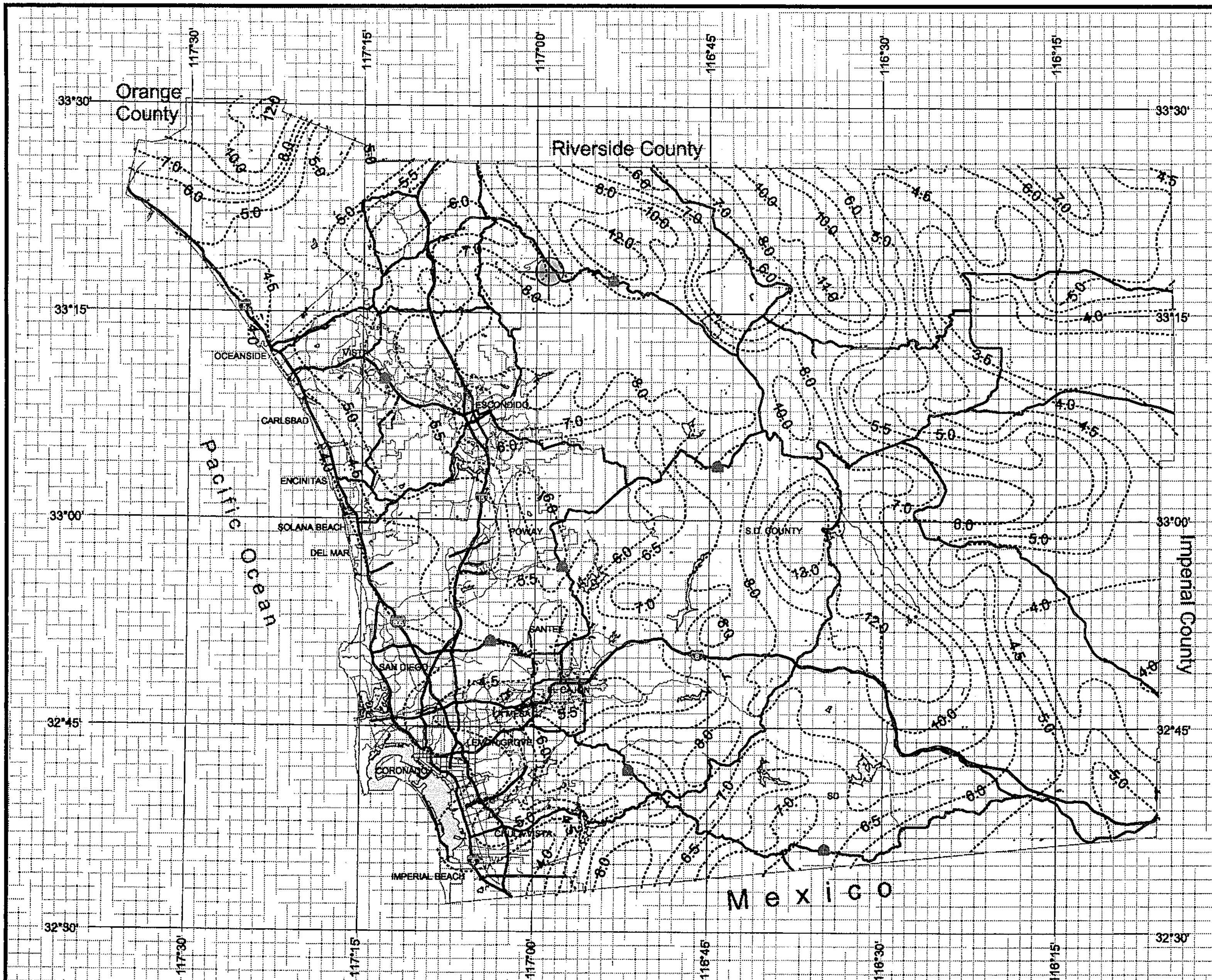

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

-------- Isopluvial (inches)

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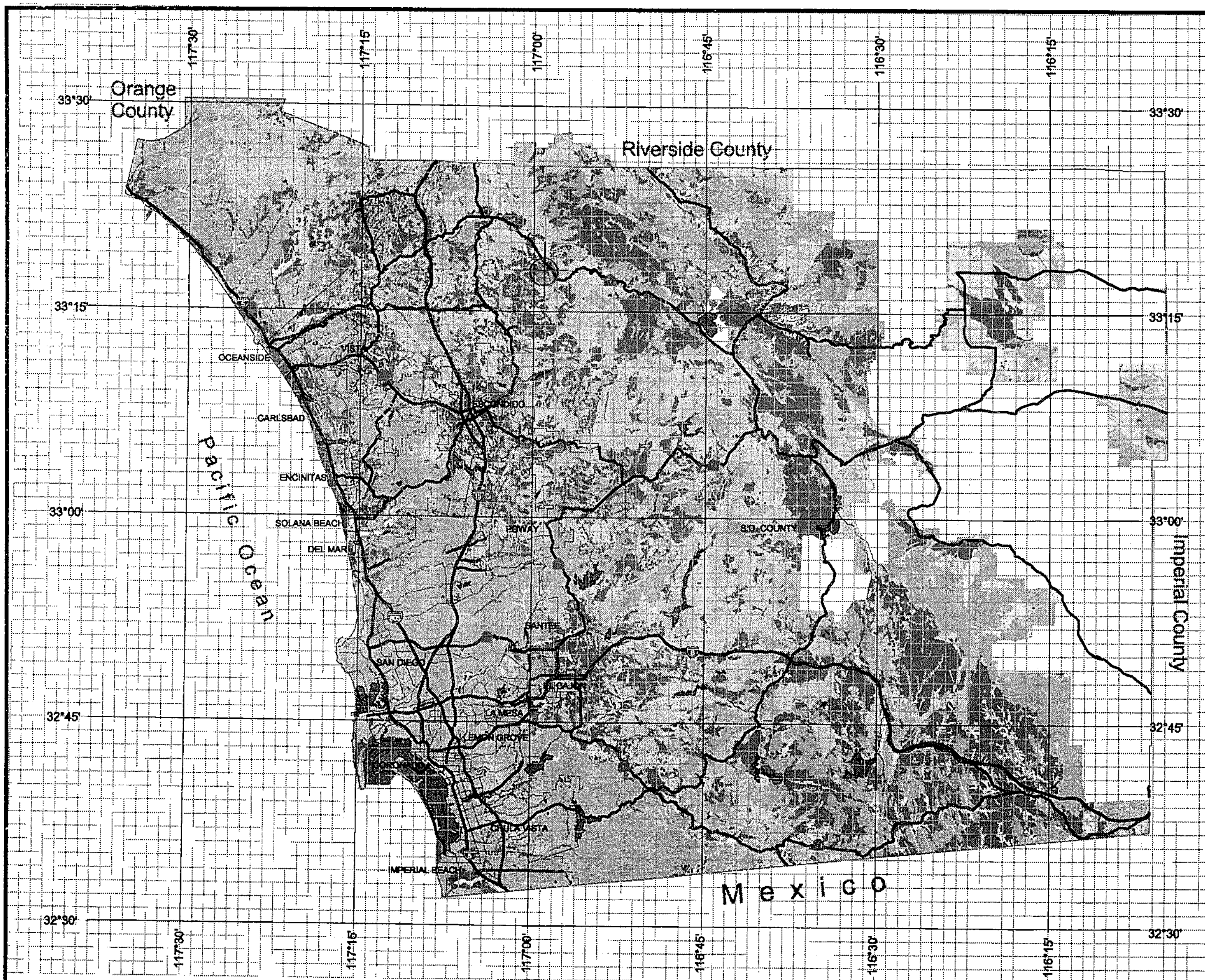
County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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PART II

SOIL SURVEY

San Diego Area, California

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service and Forest Service
in cooperation with
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION
UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Indian Affairs
DEPARTMENT OF THE NAVY
United States Marine Corps

Issued December 1973

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Soil erosion, floods, silting of reservoirs and ponds, and disastrous brush fires are hazards that confront land managers, engineers, farmers, ranchers, and homeowners in the San Diego Area. This section describes the hydrologic soil groups used to estimate the runoff potential of the soils, rates the erodibility of the soils, and indicates the degree of soil limitations for conversion from brush vegetation to grass. The information presented can be used by planners in estimating the effect of water and runoff on the soils and in determining whether grass cover can be established in areas of brush for controlling fires and erosion.

Hydrologic Soil Groups

Surface runoff and soil erosion create serious problems in engineering and agriculture. Hydrologic studies are invaluable for estimating the runoff from a given area and designing flood-control structures adequate to handle the runoff water.

Four hydrologic groups are used for estimating the runoff potential of soils. Group A has the lowest runoff potential, and Group D has the highest. Groupings are based on soil properties that influence runoff, such as the water infiltration rate, texture, natural drainage or wetness, and the presence of a restrictive underlying layer or rock material. The runoff potential is calculated on the basis of water intake at the end of a long-duration storm that occurs after prior wetting and opportunity for swelling of a soil not protected by vegetation.

Group A. Soils have high infiltration rate when thoroughly wetted; chiefly deep, well-drained to excessively drained sand, gravel, or both. Rate of water transmission is high; thus runoff potential is low.

Group B. Soils have moderate infiltration rate when thoroughly wetted; chiefly soils that are moderately deep to deep, moderately well drained to well drained, and moderately coarse textured. Rate of water transmission is moderate.

Group C. Soils have slow infiltration rate when thoroughly wetted; chiefly soils that have a layer impeding downward movement of water, or moderately fine to fine textured soils that have a slow infiltration rate. Rate of water transmission is slow.

Group D. Soils have very slow infiltration rate when thoroughly wetted; chiefly clays that have a high shrink-swell potential, soils that have a high permanent water table, soils that have a claypan or clay layer at or near the surface, or soils that are shallow over nearly impervious material. Rate of water transmission is very slow.

Detailed hydrologic soil maps are available from the San Diego County Planning Department. The hydrologic group designation for each soil in the Area is given in table 11.

Ground Cover.--The amount of runoff produced during a storm depends on the ability of the soils to absorb water and on the kind of ground cover. Plant cover increases absorption of water and slows runoff (8). [3/] Manmade cover usually decreases absorption of water, increases runoff, modifies the natural drainage patterns, and intensifies the chances of flooding. For example, a paved parking lot produces more runoff than an unpaved field. Excess runoff in areas of manmade cover increases the load of drainage systems, which may lack the capacity to handle floodwater.

Although the type of cover is not considered in the hydrologic groups, it is an important factor in estimating runoff. The ground cover of the watershed in the western part of the San Diego Area has been divided into eighteen categories according to the dominant kinds of plant cover and land use that affect hydrologic characteristics. The categories include barren land, developed land, wild land, and cultivated land. Atlas maps that show these areas are available at the San Diego County Planning Department.

Soil Erodibility by Water

Water erosion affects all uses of the soils. Runoff erodes agricultural land and undercuts roadbanks, landfills, and riverbanks. Eroded materials fill reservoirs, ponds, and drainage ditches and silt up harbors, streams, and rivers (9).

The erodibility of soils must be considered in planning land use. It is especially important in selecting homesites. Where erosion is a severe problem, proper precautions can be taken or other uses can be considered.

The erodibility of each soil in the Area is rated in table 11. The ratings are slight, moderate, and severe. A rating of slight indicates that water erosion is a minor problem and the soil is suitable for building sites or other intensive use if other factors are favorable. Ratings of moderate and severe indicate that protective and corrective measures are needed before and during the time the soil is used.

[3/] Underscored numbers in parentheses refer to Literature Cited, page 116.

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Hydrologic Soil Groups and Land Use Map

(Joins sheet 13, Pala quadrangle)

. it used, shows the class
s. A final number, 2 or 3,
·oded.

NAME
ɔ silt loam, 2 to 5 percent slopes
ɔ silt loam, saline, 0 to 2 percent slopes
ɔ silt loam, dark variant
hen Creek loamy coarse sand, 5 to 9 percent slopes
hen Creek loamy coarse sand, 9 to 15 percent slopes, oded
ᵓosta loamy coarse sand, 5 to 30 percent slopes, eroded
ᵓosta loamy coarse sand, 5 to 30 percent slopes, severely oded
ᵓosta rocky loamy coarse sand, 5 to 30 percent slopes
ᵓosta rocky loamy coarse sand, 5 to 30 percent slopes, oded
ᵓosta rocky loamy coarse sand, 30 to 50 percent slopes, oded
ᵓosta-Sheephead complex, 9 to 30 percent slopes
ᵓosta-Sheephead complex, 30 to 65 percent slopes
Flores loamy fine sand, 2 to 9 percent slopes
Flores loamy fine sand, 5 to 9 percent slopes, eroded
Flores loamy fine sand, 9 to 15 percent slopes
Flores loamy fine sand, 9 to 15 percent slopes, eroded
Flores loamy fine sand, 15 to 30 percent slopes
Flores loamy fine sand, 15 to 30 percent slopes, eroded
Flores loamy fine sand, 9 to 30 percent slopes, severely oded
Flores-Urban land complex, 2 to 9 percent slopes
Flores-Urban land complex, 9 to 30 percent slopes
Posas fine sandy loam, 2 to 5 percent slopes
Posas fine sandy loam, 5 to 9 percent slopes
Posas fine sandy loam, 5 to 9 percent slopes, eroded
Posas fine sandy loam, 9 to 15 percent slopes, eroded
Posas fine sandy loam, 15 to 30 percent slopes, eroded
Posas stony fine sandy loam, 9 to 30 percent slopes
Posas stony fine sandy loam, 9 to 30 percent slopes, oded
Posas stony fine sandy loam, 30 to 65 percent slopes
e clay loam, 9 to 30 percent slopes
e clay loam, 30 to 50 percent slopes
ıy alluvial land
ıy alluvial land-Huerhuero complex, 9 to 50 percent opes, severely eroded
land
ıa loamy coarse sand, 2 to 9 percent slopes
ıa loamy coarse sand, 9 to 30 percent slopes
a coarse sandy loam, 0 to 2 percent slopes
a coarse sandy loam, 2 to 5 percent slopes
a sandy loam, saline, 0 to 2 percent slopes
a fine sandy loam, 0 to 2 percent slopes, eroded
morphic rock land
ville loamy coarse sand, 0 to 2 percent slopes
ville loamy coarse sand, 2 to 9 percent slopes
ville loamy coarse sand, 9 to 15 percent slopes
ville loamy coarse sand, wet, 0 to 2 percent slopes
nhain cobbly loam, 2 to 9 percent slopes
nhain cobbly loam, 9 to 30 percent slopes
nhain cobbly loam, 30 to 50 percent slopes
nhain-Urban land complex, 2 to 9 percent slopes
nhain-Urban land complex, 9 to 30 percent slopes
ntia sandy loam, 0 to 2 percent slopes
ntia sandy loam, 2 to 9 percent slopes
ntia sandy loam, 5 to 9 percent slopes, eroded
ntia sandy loam, 9 to 15 percent slopes, eroded
ntia sandy loam, thick surface, 0 to 2 percent slopes
ntia sandy loam, thick surface, 2 to 9 percent slopes
s

SYMBOL	NAME
RaA	Ramona sandy loam, 0 to 2 percent slopes
RaB	Ramona sandy loam, 2 to 5 percent slopes
RaC	Ramona sandy loam, 5 to 9 percent slopes
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes
RdC	Redding gravelly loam, 2 to 9 percent slopes
ReE	Redding cobbly loam, 9 to 30 percent slopes
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes
RhC	Redding-Urban land complex, 2 to 9 percent slopes
RhE	Redding-Urban land complex, 9 to 30 percent slopes
RkA	Reiff fine sandy loam, 0 to 2 percent slopes
RkB	Reiff fine sandy loam, 2 to 5 percent slopes
RkC	Reiff fine sandy loam, 5 to 9 percent slopes
Rm	Riverwash
RoA	Rositas fine sand, 0 to 2 percent slopes
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes
RuG	Rough broken land
SbA	Salinas clay loam, 0 to 2 percent slopes
SbC	Salinas clay loam, 2 to 9 percent slopes
ScA	Salinas clay, 0 to 2 percent slopes
ScB	Salinas clay, 2 to 5 percent slopes
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded
SrD	Sloping gullied land
SsE	Soboba stony loamy sand, 9 to 30 percent slopes
StG	Steep gullied land
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes
SvE	Stony land
TeF	Terrace escarpments
Tf	Tidal flats
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes
TuB	Tujunga sand, 0 to 5 percent slopes
Ur	Urban land
VaA	Visalia sandy loam, 0 to 2 percent slopes
VaB	Visalia sandy loam, 2 to 5 percent slopes
VaC	Visalia sandy loam, 5 to 9 percent slopes
VaD	Visalia sandy loam, 9 to 15 percent slopes
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes
VsC	Vista coarse sandy loam, 5 to 9 percent slopes
VsD	Vista coarse sandy loam, 9 to 15 percent slopes
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded
VsE	Vista coarse sandy loam, 15 to 30 percent slopes
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded
VsG	Vista coarse sandy loam, 30 to 65 percent slopes
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes
WmB	Wyman loam, 2 to 5 percent slopes
WmC	Wyman loam, 5 to 9 percent slopes
WmD	Wyman loam, 9 to 15 percent slopes

Map symbol	Soil	Hydrologic group	Erodibility	Limitations for conversion from brush to grass
RaA	Ramona sandy loam, 0 to 2 percent slopes	C	Severe 16	Slight.
RaB	Ramona sandy loam, 2 to 5 percent slopes	C	Severe 16	Slight.
RaC	Ramona sandy loam, 5 to 9 percent slopes	C	Severe 16	Slight.
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded	C	Severe 16	Slight.
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded	C	Severe 16	Slight.
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes	C	Severe 16	Slight.
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes	C	Severe 16	Slight.
RdC	Redding gravelly loam, 2 to 9 percent slopes	D	Severe 9	Moderate.
ReE	Redding cobbly loam, 9 to 30 percent slopes	D	Severe 9	Moderate.
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes.	D	Severe 1	Moderate.
RhC	Redding-Urban land complex, 2 to 9 percent slopes:			
	Redding	D		
	Urban land	D		
RhE	Redding-Urban land complex, 9 to 30 percent slopes:			
	Redding	D		
	Urban land	D		
RkA	Reiff fine sandy loam, 0 to 2 percent slopes	B	Severe 16	Slight.
RkB	Reiff fine sandy loam, 2 to 5 percent slopes	B	Severe 16	Slight.
RkC	Reiff fine sandy loam, 5 to 9 percent slopes	B	Severe 16	Slight.
Rm	Riverwash	A	Severe 2, 4	Severe.
RoA	Rositas fine sand, 0 to 2 percent slopes	A	Severe 2	
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes	A	Severe 2	
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes	A	Severe 2	
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes	A	Severe 2	
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes	A	Severe 2	
RuG	Rough broken land	D	Severe 1	Severe.
SbA	Salinas clay loam, 0 to 2 percent slopes	C	Moderate 2	Slight. 1/
SbC	Salinas clay loam, 2 to 9 percent slopes	C	Moderate 2	Slight. 1/
ScA	Salinas clay, 0 to 2 percent slopes	C	Slight	Slight. 1/
ScB	Salinas clay, 2 to 5 percent slopes	C	Slight	Slight. 1/
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes	D	Severe 9	Moderate.
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes:			
	San Miguel	D	Severe 1	Severe.
	Exchequer	D	Severe 1	Severe.
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded.	C	Severe 16	Moderate. 4/
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded.	C	Severe 1	Moderate. 4/
SrD	Sloping gullied land	B	Severe 2	Severe. 4/
SsE	Soboba stony loamy sand, 9 to 30 percent slopes	A	Severe 2	Moderate.
StG	Steep gullied land	D	Severe 1	Severe.
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes	D	Moderate 2	Slight.
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes	D	Moderate 2	Slight.
SvE	Stony land	A	Severe 1	Severe.
TeF	Terrace escarpments	D	Severe 1	Severe.
Tf	Tidal flats	D	Severe 2, 4	
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded.	C	Severe 9	Severe.
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes.	C	Severe 1	Severe.
TuB	Tujunga sand, 0 to 5 percent slopes	A	Severe 2	Slight.
Ur	Urban land	D		
VaA	Visalia sandy loam, 0 to 2 percent slopes	B	Severe 16	Slight.

See footnotes at end of table.

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TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
VaB	Visalia sandy loam, 2 to 5 percent slopes----------------	B	Severe 16----	Slight.
VaC	Visalia sandy loam, 5 to 9 percent slopes----------------	B	Severe 16----	Slight.
VaD	Visalia sandy loam, 9 to 15 percent slopes---------------	B	Severe 16----	Slight.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes-------	B	Severe 16----	Slight.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes-------	B	Severe 16----	Slight.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes-----------	B	Moderate 2---	Slight.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes----------	B	Moderate 2---	Slight.
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	B	Moderate 2---	Slight.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes---------	B	Moderate 2---	Slight.
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	B	Moderate 2---	Slight.
VsG	Vista coarse sandy loam, 30 to 65 percent slopes---------	B	Severe 1------	Moderate.
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	B	Moderate 2----	Moderate. 3/
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	B	Moderate 2----	Moderate. 3/
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	B	Severe 1------	Moderate. 3/
WmB	Wyman loam, 2 to 5 percent slopes------------------------	C	Moderate 2----	Slight.
WmC	Wyman loam, 5 to 9 percent slopes------------------------	C	Moderate 2----	Slight.
WmD	Wyman loam, 9 to 15 percent slopes-----------------------	C	Moderate 2----	Slight.

1/ Typically a grassland soil; conversion from brush usually not necessary.

2/ Moderate if slope is more than 30 percent, slight if less than 30 percent.

3/ Stoniness or rockiness not a serious impediment to use of grass-planting equipment.

4/ On desert-facing mountain slopes and in valleys, in the eastern part of land resource area 20, the degree of limitation is severe because of climate, regardless of soil properties.

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

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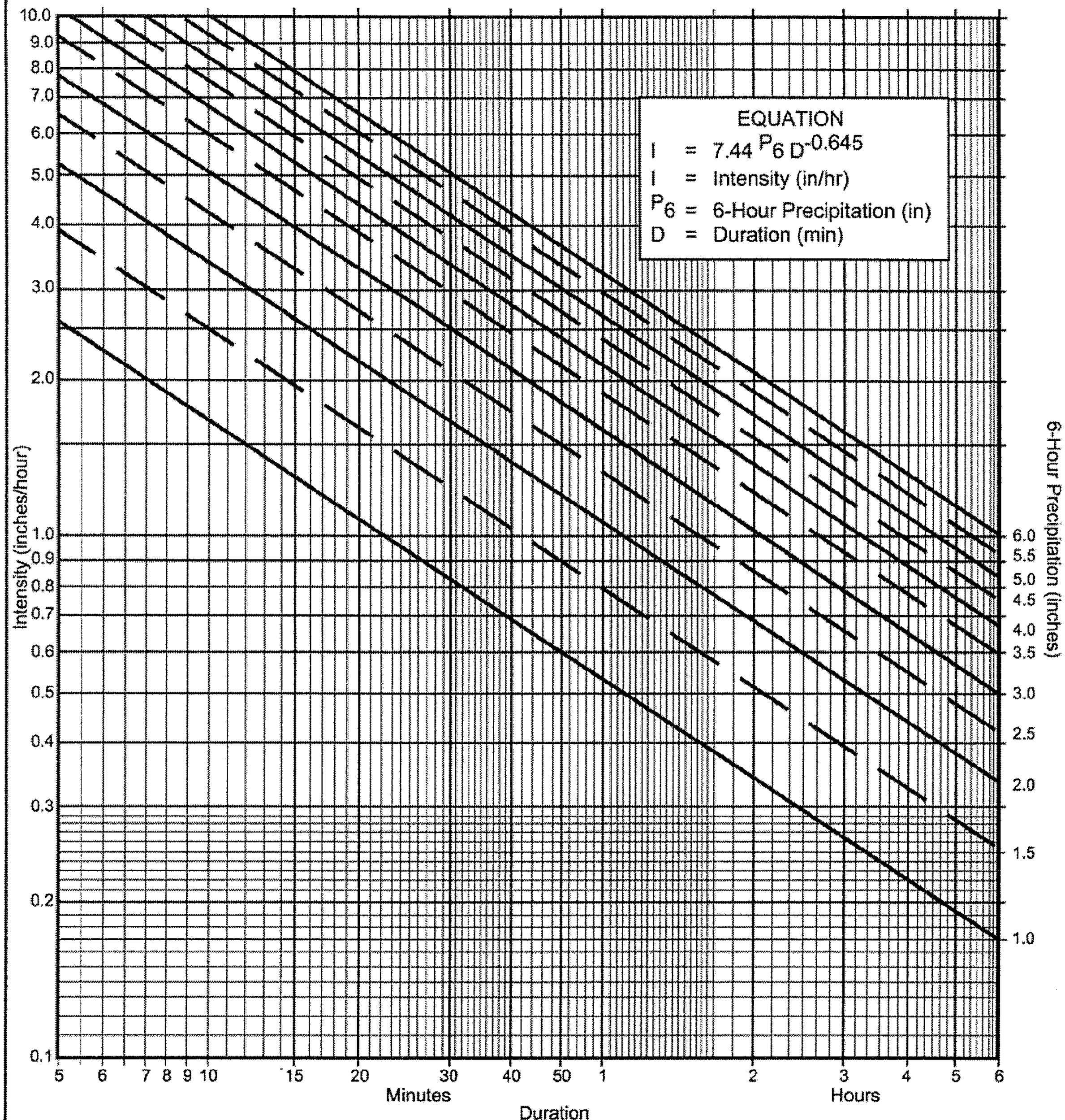


Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.8 in., P_{24} = 7.1, $\frac{P_6}{P_{24}}$ = 54 %(2)

(c) Adjusted $P_6^{(2)}$ = 3.8 in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

12

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

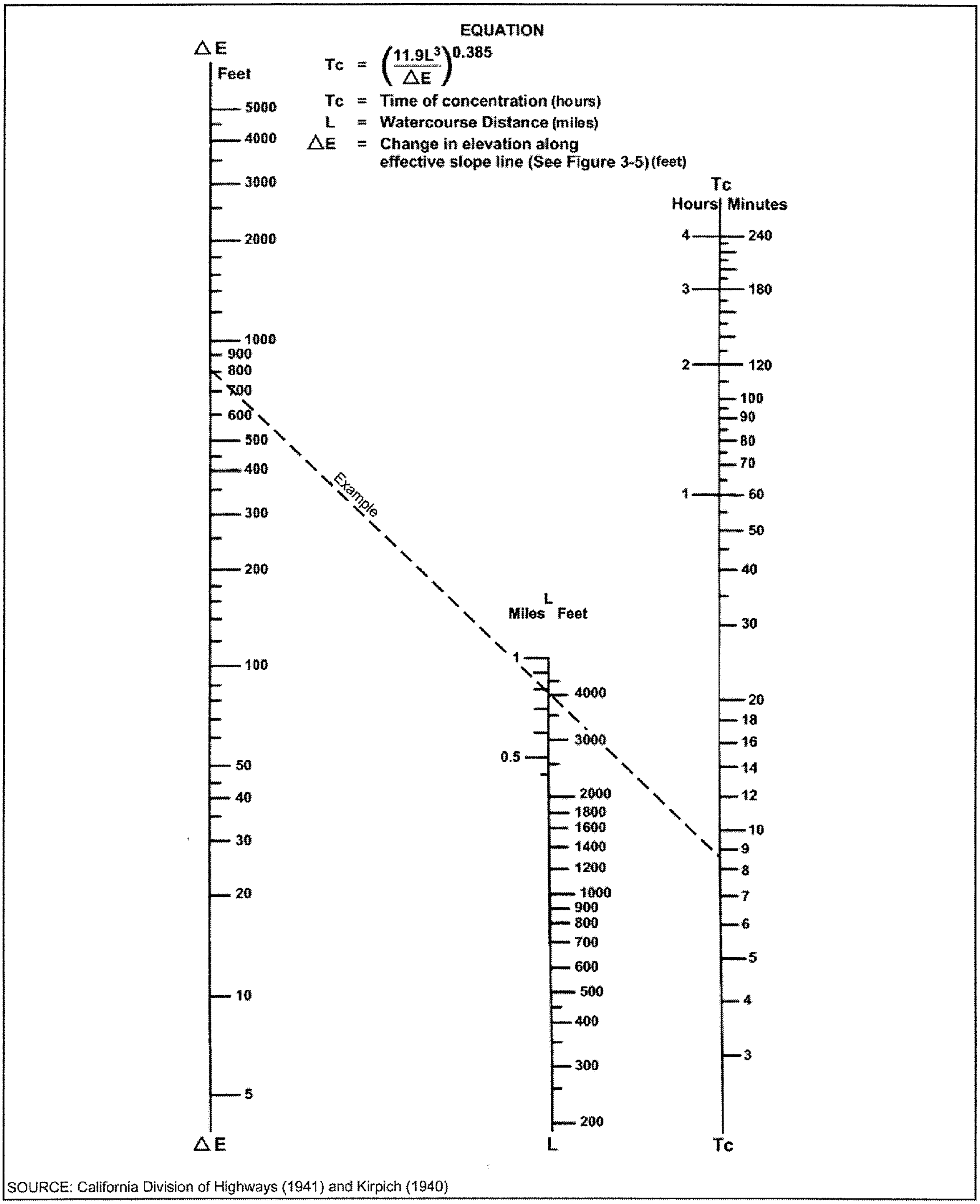
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/	.5%		1%		2%		3%		5%		10%	
	Acre	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

FIGURE
3-4

On-Site Runoff Coefficient Calculations (C)

This site has a future land use of Low Density Residential (LDR).

Drainage Area Onsite, 34.5 acres, has 11.0 acres in Soil Group A according to the Soil Hydrologic Group Map with a C of 0.27 [Table 3-1], 22.3 acres in Soil Group B with a C of 0.32, and 1.2 acres in Soil Group C with a C of 0.36.

In order to utilize a Pre-Development common Runoff Coefficient for this area, weighted proportions are proposed for a weighted average C as follows:

C=(11.0/34.5 x 0.27)+(22.3/34.5 x 0.32)+(1.2/34.5 x 0.36)=0.09+0.21+0.01=0.31=Weighted C

The proposed development would create 1.9 acres of road paving and 30 lots with an average impervious surface of 5,000 sf each; totaling 3.4 acres:
1.9+3.4=5.3 acres/34.5 acres=0.15=Proposed percent impervious value: 15%

C=0.90 (% impervious) + C_p (1-% impervious) [Table 3-1] and [Section 3.1.2]

Soil Group A: C=0.90 (0.15) + 0.20 (1-0.15)=0.31
Soil Group B: C=0.90 (0.15) + 0.25 (1-0.15)=0.35
Soil Group C: C=0.90 (0.15) + 0.30 (1-0.15)=0.39

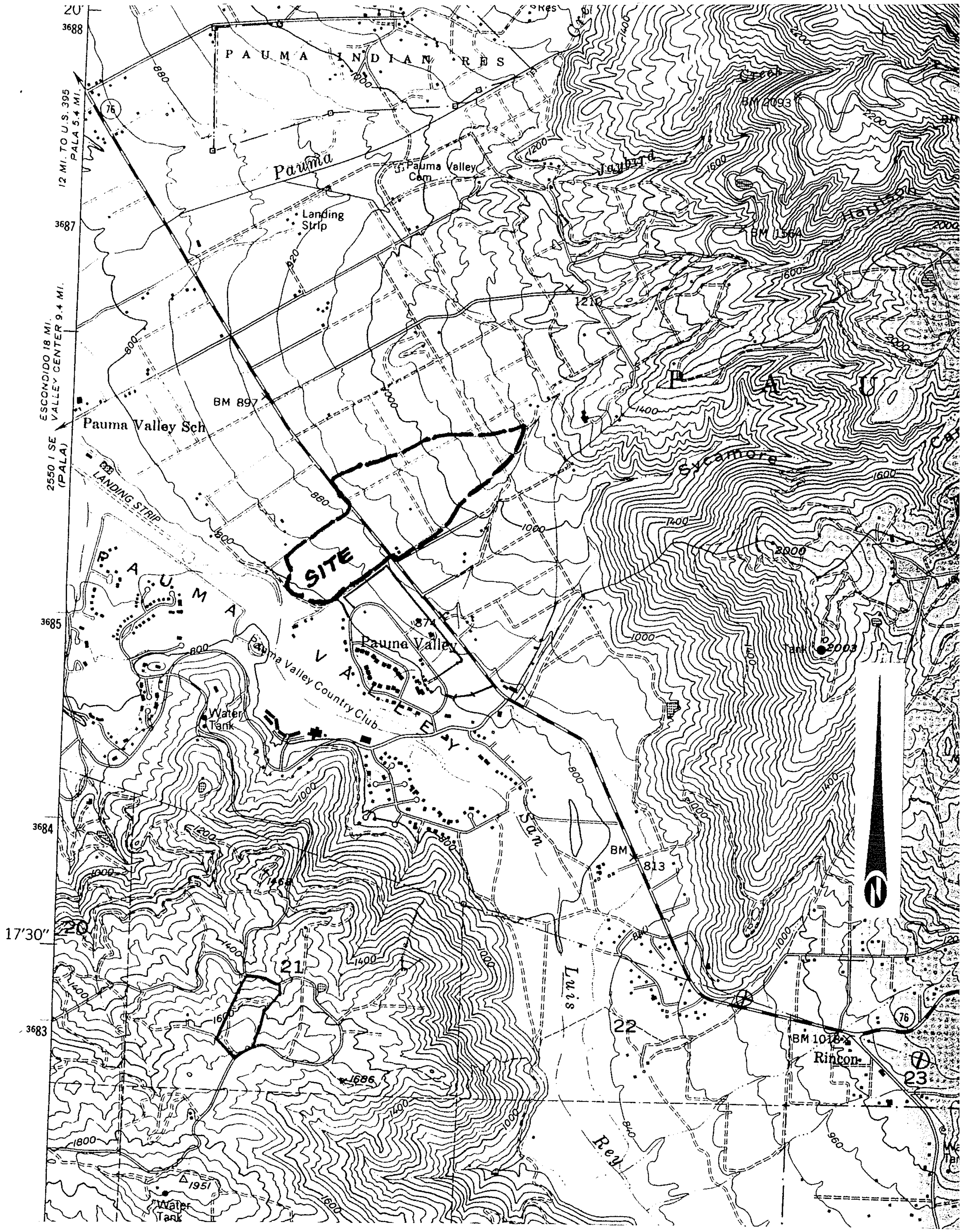
In order to utilize a Post-Development common Runoff Coefficient for this area, weighted proportions are proposed for a weighted average C as follows:

C=(11.0/34.5 x 0.31)+(22.3/34.5 x 0.35)+(1.2/34.5 x 0.39)=0.10+0.23+0.01=0.34=Weighted C

Drainage Areas A, B and C are Post-Development configurations which have been assigned a Runoff Coefficient C=0.34 by consideration of conceptual percent imperviousness.

Site Latitude of 33°18" North and Longitude of 116°59" West have been determined from the 200 Scale Site and Vicinity Topography Map.

PRE-DEVELOPMENT DRAINAGE MAP



CLUB ESTATES ~ TM 5499 RPL2
PRE-DEVELOPMENT HYDROLOGY CALCULATIONS
Peak Flow

$P6$ = 3.80 inches

POINT OF CONCENTRATION	S (%)	L (ft.)	Table 3-2 Ti (min.)	H (ft.)	L (ft.)	Fig. 3-4 Tt (min.)	Ti+Tt= Tc (min.)	i_{100} (in./hr.)	C *	A (ac.)	Q_{100} (cfs)
FLOODPLAIN @ NW Property Line	10	100	6.4	517	6825	18.9	25.3	3.52	0.31	210.5	229.6

* Weighted for soil types

In addition, approximately 17 cfs flows southwesterly along an asphalt drive located adjacent to the northwesterly project boundary, which moves onsite just prior to entering the floodplain. **246.6 Total**

Section 3.1.4 of the Hydrology Manual states "When analizing storm drain systems, the designer must consider the possiblity that an existing natural watershed may become urbanized during the useful life of the storm drain system.
Future land uses must be used for Tc and runoff calculations, and can be determined from the local Community General Plan."

Flow from Point Node 01 to Node Z (See Offsite Access Drainage Basins Map, enclosed for Subarea Z configuration & delineation)

Area 01+ 02+ 03 + Subarea Z=95.9+ 60.4+ 19.7+17.4=193.4 ac.
Q_{ave}= (Q_{01}+Q_{02}+Q_{03}) + [(q_{ave}) (A_z)/2]=189.6+[(0.2 cfs/acre) (17.4 acres)/2]=191.3 cfs
Slope (s) $_{ave}$ = 888-798/1500'=6.0%
Velocity (V) $_{ave}$=10.0 feet per second (fps) [Mannings]
Travel Time (Tt) $_{ave}$ =1500'/10.0 fps=2.5 minutes
Tc= T_{01}+ T_t=26.4+2.5=28.9 minutes [See page 18 for T_{01}]
I_{100}=(7.44)(P6)(D^-0.645) [Figure 3-1] =3.23 inches/hour
Q_{100}=(C)(I_{100})(A)=**193.6 cfs at Node Z**
Assumption for Q_{ave}: Q_{ave}= (Q_{01}+Q_{02}+Q_{03}) + (Q_z – [Q_{01}+Q_{02}+Q_{03}]/2)=191.6 cfs => OK

In the existing, pre-development condition this flow leaves the project site onto the adjoining property and travels 312' in an improved asphalt lined swale; then returns onsite to continue in the existing asphalt swale to the river's edge.
See the project Preliminary Grading Plan sheet 1, Detail A.

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OFF-SITE UPSTREAM HYDROLOGY CALCULATIONS

Peak Flow

P6 = 3.80 inches

POINT OF CONCENTRATION	S (%)	L (ft.)	Table 3-2 Ti (min.)	H (ft.)	L (ft.)	Fig. 3-4 Tt (min.)	Ti+Tt= Tc (min.)	i_{100} (in./hr.)	C	A (ac.)	Q_{100} (cfs)
									*		
O1	5	100	8.0	415	6200	18.4	26.4	3.42	0.27	95.9	88.6
O2	10	100	6.4	336	4080	12.3	18.7	4.27	0.27	60.4	69.7
O3	5	100	8.0	183	2360	8.3	16.3	4.68	0.34	19.7	31.3

* Drainage Basins 01 and 02 have Soil Type "A", therefore C = 0.27 per Table 3-1

** Drainage Basin 03 has 40% Soil Type "B" and 60% Soil Type "C".
Therefore a weighted C of 0.34 has been utilized.

OFF-SITE UPSTREAM HYDRAULIC CALCULATIONS~Inlet control conditions

	Existing Culvert	HW Existing	Existing Capacity (cfs)	Recommendations
O1	36" Cmp	3.5'	44	Replace with 2-36" CMP with Hdwall & 48" CMP system
O2	30" Cmp	5.0'	46	Replace with 2-30" CMP with Hdwall
O3	24" Cmp	4.0'	28	Replace with 27" CMP with Hdwall

OFF-SITE UPSTREAM HYDRAULIC CALCULATIONS~Channel & Culvert Calculations

O1	See Appendix 01
O2	See Appendix 02
O3	See Appendix 03

On-site Post-Development Model Nodes A, B and C Hydrology

$P6_{100}$=3.8 [Precipitation Maps, Figure 3-1]
C=0.34 [Weighted C]

Characterization of Flows in Basins A, B and C

These areas receive off-site flows from Nodes 01, 02 and 03. The open channels have been designed to carry the peak flows and replace the existing swales yet still provide "soft-bottoms" to allow infiltration and natural water quality aesthetics for wildlife. Turf reinforcement mats are proposed to control erosion potential.

Flow from Point Node 03 to Node A

Area 03+A=19.7+14.8=34.5 ac.
Q_{ave}= Q_{03} + [(q_{ave}) (A_A)/2]=31.3+[(1.3cfs/acre) (14.8 acres)/2]=40.9 cfs
Slope (s) ave = 875-790/1450'=5.9%
Velocity (V) ave=10.0 feet per second (fps) [Mannings]
Travel Time (Tt) ave =1450'/10.0 fps=2.4 minutes
Tc= T_{03}+ Tt=16.3+2.4=18.7 minutes
I_{100}=(7.44)(P6)(D^-0.645) [Figure 3-1] =4.28 inches/hour

Q_{100}=(C)(I_{100})(A)=<u>50.2 cfs at Node A</u>

Assumption for Q_{ave}:
Q_{ave}= Q_{03} + (Q_A – Q_{03}/2)=40.8 cfs => OK

A comparison with the Pre-Development flow shown on page 17 indicates the dramatic decrease in discharge at Node Z for the adjoining property owner to the southeast. See Appendix Z for the hydraulic calculation of this reduced flow in the existing improved asphalt lined swale.

Flow from Point Node 02 to Node B

Area 02+B=60.4+18.0=78.4 ac.
Q_{ave}=Q_{02} + [(q_{ave}) (A_B)/2]=69.7+[(1.9cfs/acre) (18.0 acres)/2=86.8 cfs
Slope (s) ave = 875-794/1650'=4.9%
Velocity (V) ave=10.0 feet per second (fps) [Mannings]
Travel Time (Tt) ave =1650'/10.0 fps=2.8 minutes
Tc= T_{02}+ Tt=18.7+2.8=21.5 minutes
I_{100}=(7.44)(P6)(D^-0.645) [Figure 3-1] =3.91 inches/hour

Q_{100}=(C)(I_{100})(A)=<u>104.2 cfs at Node B</u>

Assumption for Q_{ave}:
Q_{ave}= Q_{02} + (Q_B – Q_{02}/2)=87.0 cfs => OK

Characterization of Flows in Basin C

This area is the remaining 1.7 acres of the Onsite development Drainage Area consisting of Lot 16 and the proposed earthen channel along the subject property's northwesterly boundary mentioned above. It has a Tc of 11.5 minutes [Table 3-2]. (Ditch travel time is small with respect to the Lot Ti).
I_{100}=(7.44)(P6)(D ^ -0.645) [Figure 3-1] =5.85 inches/hour

Q_{100}=(C)(I_{100})(A)=2.0 cfs at Node C

The total flow at Node C will include the 88.6 cfs, from Node 01 via the proposed offsite and onsite storm drain, from the proposed earthen channel along the subject property's northwesterly boundary for a
Total Q_{100}=90.6 cfs at Node C

Summation of Project Flows

Total Post-Development** Q_{100} **Flow at the River's Floodplain: =QA+QB+QC=245.0 cfs
This conservative summation compares to 246.6 cfs Pre-Development per page 17.

This Report has been presented in the Pre-development condition with one Basin total point of concentration in the vicinity of the junction of the River floodplain with the northwesterly property line. Therefore, no values of comparison with Post-development Pc's were possible at that point since flows follow different paths in each instance. Thus, only the total flows may be compared.

These outfalls are within the subject property with attenuated free outlets above the floodplain. No diversions are proposed. Therefore no project related downstream drainage impacts are expected. No "waiver and release" forms are required from downstream owners since no concentrations of flows are proposed near adjacent property lines, and no further offsite downstream review is necessary.

The apparent decrease, or general non-increase of anticipated flows from these calculations is due to the "storage of water on the surface in depressions and in the form of surface flow depth and storage in conveyance systems." This is a direct quote from a report entitled Evaluation of Rational Method "C" Values *(Hill, 2002). It further states that "most single-family residential units have lawns and/or landscaped areas that are more pervious than most natural soils and vegetation cover in the San Diego coastal and foothill area." These results have been revealed even in light of an increase in proposed impervious surfaces and the resulting Post-Development Runoff Coefficients. (Please see page 15.)*

Temporary storage of portions of the runoff generated by storms; from the shallow ponding on the pads, in storm drains and flatter landscaped areas which will be created, delays the time of the Peak Flow in each drainage basin at its Point of Concentration. This generally effects a decrease in the expected intensity of rainfall by the time all waters falling in a basin reach the point in question. This condition helps to ensure that Post- Development peak runoff flow rates and velocities from this project site should be maintained at levels that will not cause a significant increase in downstream erosion.

Analyses of Offsite Access Roadways *are located on pages 21-22 and in Appendixes 04-07. These calculations show that the access route along: proposed Street 'C,' existing Luiseno Circle Drive and northeasterly on Pauma Valley Drive to its intersection with SR76 will adequately convey the 100-year storm.*

CLUB ESTATES ~ TM 5499 RPL2

OFF-SITE ACCESS HYDROLOGY CALCULATIONS FOR PAUMA VALLEY DRIVE AT SR76

Peak Flow

P6 = 3.90 inches

POINT OF CONCENTRATION	S (%)	L (ft.)	Table 3-2 Ti (min.)	H (ft.)	L (ft.)	Fig. 3-4 Tt (min.)	Ti+Tt= Tc (min.)	i_{100} (in./hr.)	C *	A (ac.)	Q_{100} (cfs)
O4	10	100	6.4	802	10050	24.9	31.3	3.14	0.31	160.0	156.0
O5	10	100	6.4	380	6500	20.1	26.5	3.50	0.32	95.0	106.5
O6	5	100	8.0	34	1260	7.7	15.7	4.92	0.38	2.8	5.2

* Weighted for soil types and uses per procedure described on page 15

OFF-SITE ACCESS HYDRAULIC CALCULATIONS~Inlet control conditions

	Existing Conduit	HW Existing	Existing Capacity (cfs)	Comments
O4	48" Cmp w/Hwl	8.0'	148	8 cfs bypasses to O5, 148 enters O6
O5	Trap Channel			106.5+8=114.5 cfs
O6	Trap Channel			5.2+148.0 from O4=153.2 cfs
O6	2-42" RCP w/Hwl	5.0'	156	4.8' HW required per Figure 4-3, Drainage Design Man.

OFF-SITE ACCESS HYDRAULIC CALCULATIONS~Channel & Culvert Calculations

O4 See Appendix 04
O5 See Appendix 05
O6 See Appendix 06

CLUB ESTATES ~ TM 5499 ~ RPL2

OFF-SITE ACCESS HYDROLOGY CALCULATIONS FOR LUISENO CIRCLE AND PAUMA VALLEY DRIVES

Peak Flow

P6 = 3.80 inches

POINT OF CONCENTRATION	S (%)	L (ft.)	Table 3-2 Ti (min.)	H (ft.)	L (ft.)	Fig. 3-4 Tt (min.)	Ti+Tt= Tc (min.)	i_{100} (in./hr.)	C *	A (ac.)	Q_{100} (cfs)
O7	10	100	6.4	84	1400	6.1	12.5	5.54	0.32	7.4	13.1
O8	10	100	6.4	81	1260	5.5	11.9	5.73	0.32	6.5	11.9
O9	10	100	6.4	98	2760	12.6	19.0	4.23	0.32	28.5	38.6
10	5	100	8.0	43	1320	7.4	15.4	4.85	0.32	6.7	10.4
11	5	100	8.0	50	1660	9.1	17.1	4.53	0.32	11.8	17.1
12	1	70	10.0	19	1300	9.9	19.9	4.10	0.41	5.0	8.4
13	1	70	10.0	19	1480	11.5	21.5	3.90	0.41	6.3	10.1
14	5	100	7.4	49	1990	11.3	18.7	4.28	0.38	12.4	20.2

* Determined by soil types and land uses per Table 3-1

OFF-SITE ACCESS HYDRAULIC CALCULATIONS~See Appendix O7

	Q_{100}	Street slope at Pc	Existing Capacity (cfs)	Comments
O7	13.10	0.01	53.3	Proposed Street 'C' is adequate utilizing the full street section
O7+O8	25.00	0.08	37.5	Luiseno at Street 'C' is adequate utilizing the half street section, Fig. 2-2
O7+O8+11+12	50.50	0.01	69.7	Luiseno at low point is adequate utilizing the full street section
13+14	30.30	0.01	69.7	Luiseno at low point is adequate utilizing the full street section
O9	38.60	0.003	40.1	Luiseno at Pauma Valley Dr. is adequate utilizing the full street section
1O	10.40	0.014	16.0	Pauma Valley Dr. is adequate utilizing the half street section, Fig.2-2
				The se'ly side of Pauma Valley Drive is adequate by inspection

CLUB ESTATES

CONCEPTUAL *EROSION AND SEDIMENTATION CALCULATIONS*

Approximate Near Term Sedimentation Yield:

This development site project may have all pads and roads under construction at the same time. This would involve approximately 18 acres of disturbed soil with an overall average slope of 5%.

Table 5-1 on page 24 indicates an average conservative value of 590 cubic yards of soil loss. This mass would be captured to the maximum extent practicable in a variety of erosion/siltation control devices which will be required by the Erosion Control Plan, developed during the permit processing phase. It will then be returned to the disturbed areas for embanking; virtually little net loss.

Vegetation establishment will stabilize all disturbed soil areas not being developed with other materials and uses. This should return the site to an improved condition regarding overall soil stabilization.

Approximate Long Term Sedimentation Yield:

The remaining 14 acres of this site are currently in single family dwelling use or natural vegetation. The soils have a cover of protective vegetation, grasses and leaf mulch providing adequate stabilization from erosion.

To ensure that this system remains healthy and protected from siltation to the maximum extent practicable, on-pad and lot bio-filters such as grass strips, grass swales and vegetated buffers are recommended at the individual lot drainage outlets of the development site.

Also, at the areas of storm drain outlets, velocity attenuators, where necessary for erosion control, are proposed.

Please refer to the Storm Water Management Plan for details.

Table 5-1

BASIC SOIL LOSS TABLE
(in cubic yards)*

TRACT AREA (acres)	AVERAGE SLOPES					
	2%	5%	8%	10%	12%	15%
10	270	350	370	400	450	500
15	400	420	460	600	675	750
20	540	700	740	800	900	1000
40	1080	1400	1480	1600	1800	2000
80	2160	2800	2960	3200	3600	4000
100	2700	3500	3700	4000	4500	5000
150	4000	4200	4600	6000	6750	7500
200	5400	7000	7400	8000	9000	10000

*Engineer shall interpolate the figures listed in the table as required.